National Park Service

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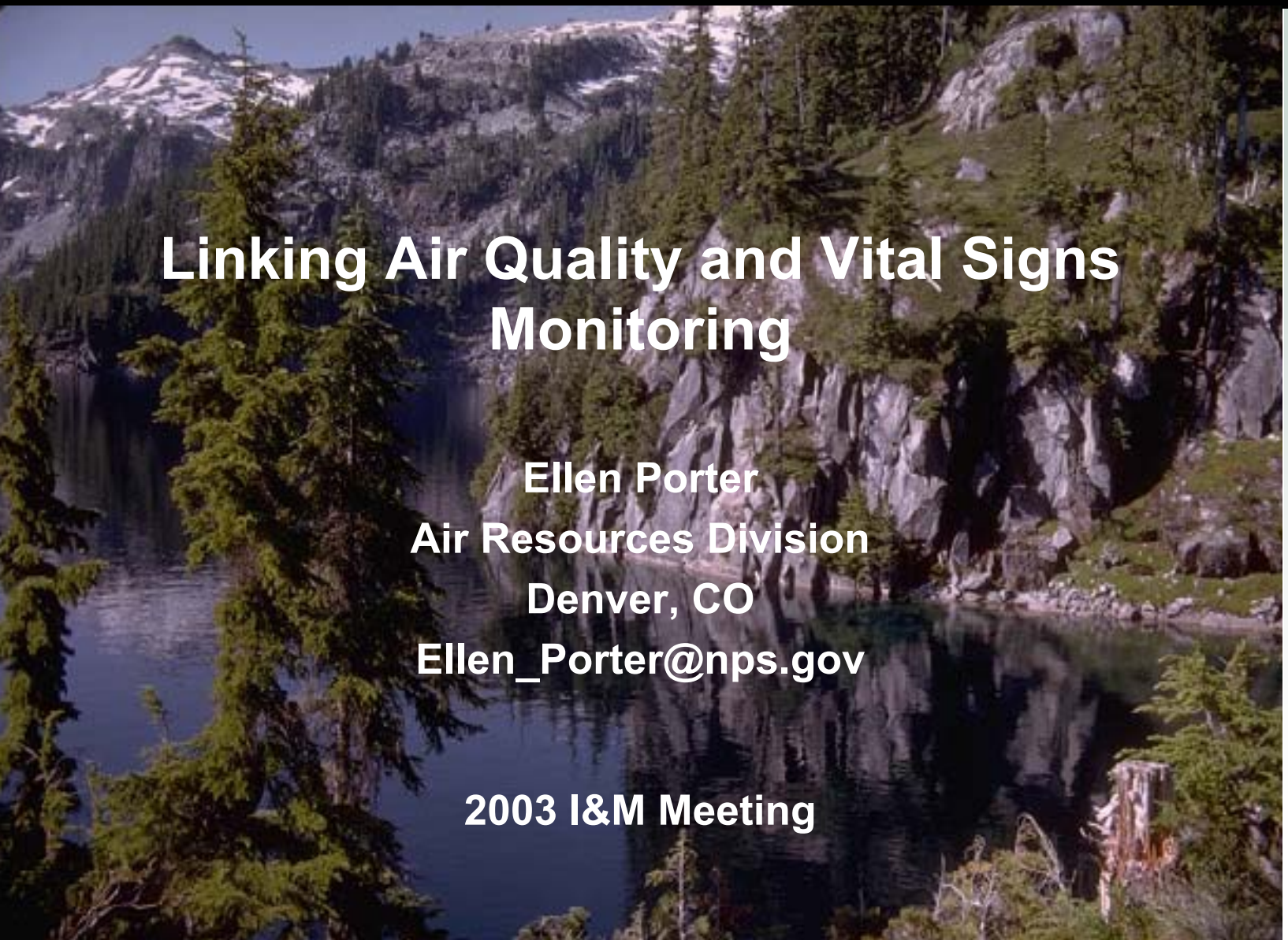

Linking Air Quality and Vital Signs Monitoring

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2003 I&M Meeting

National Park Service

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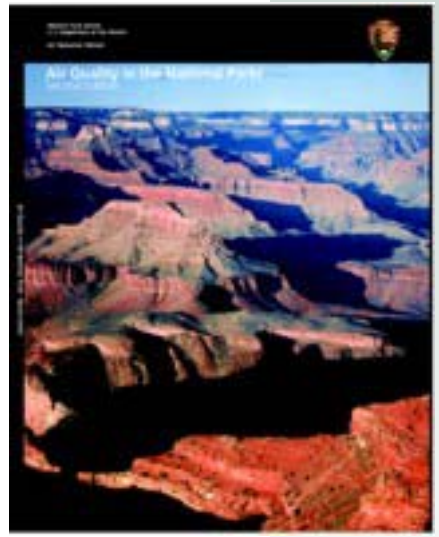
Air Quality in the National Parks



- All parks contain resources sensitive to air pollution.

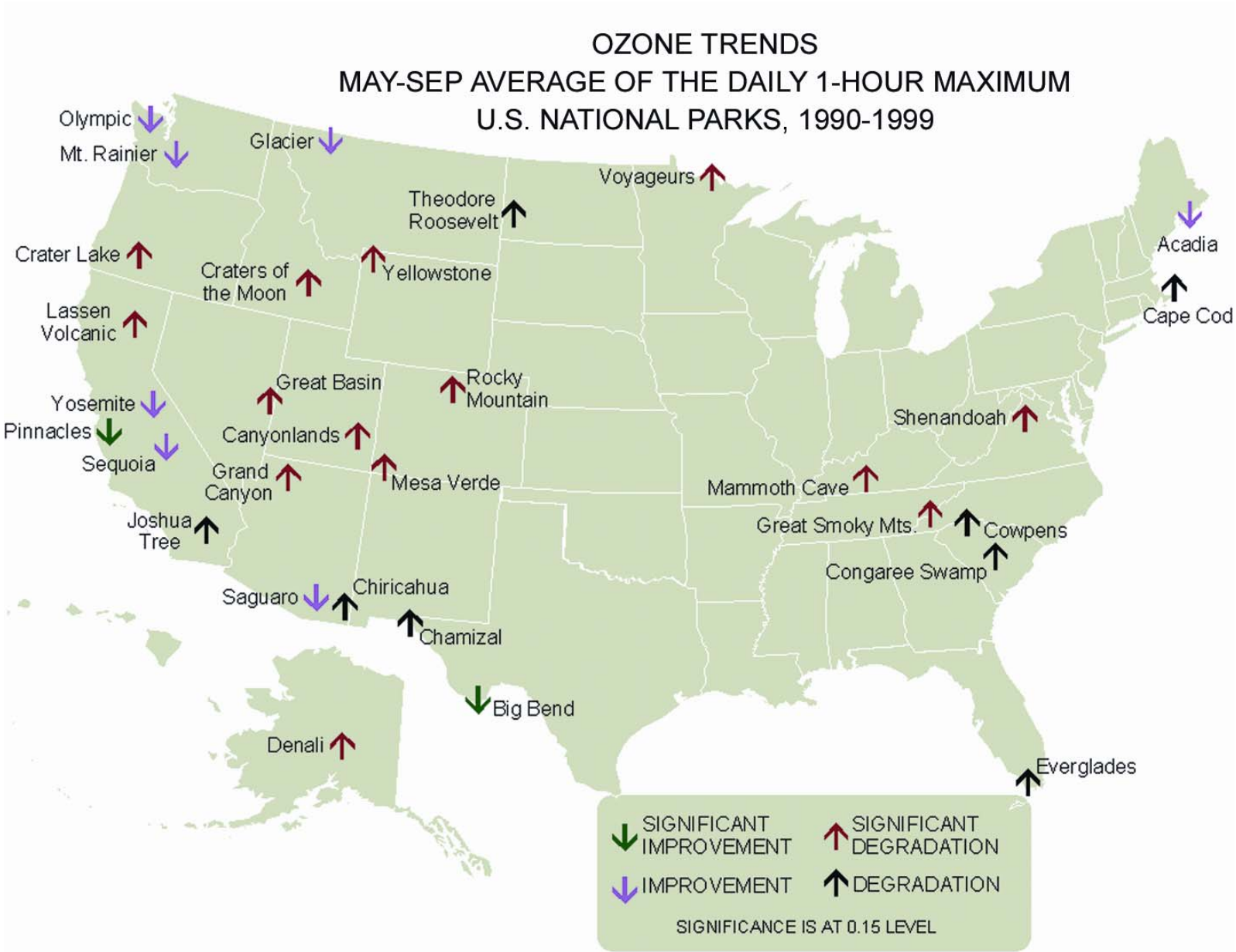
- All parks are affected by air pollution.

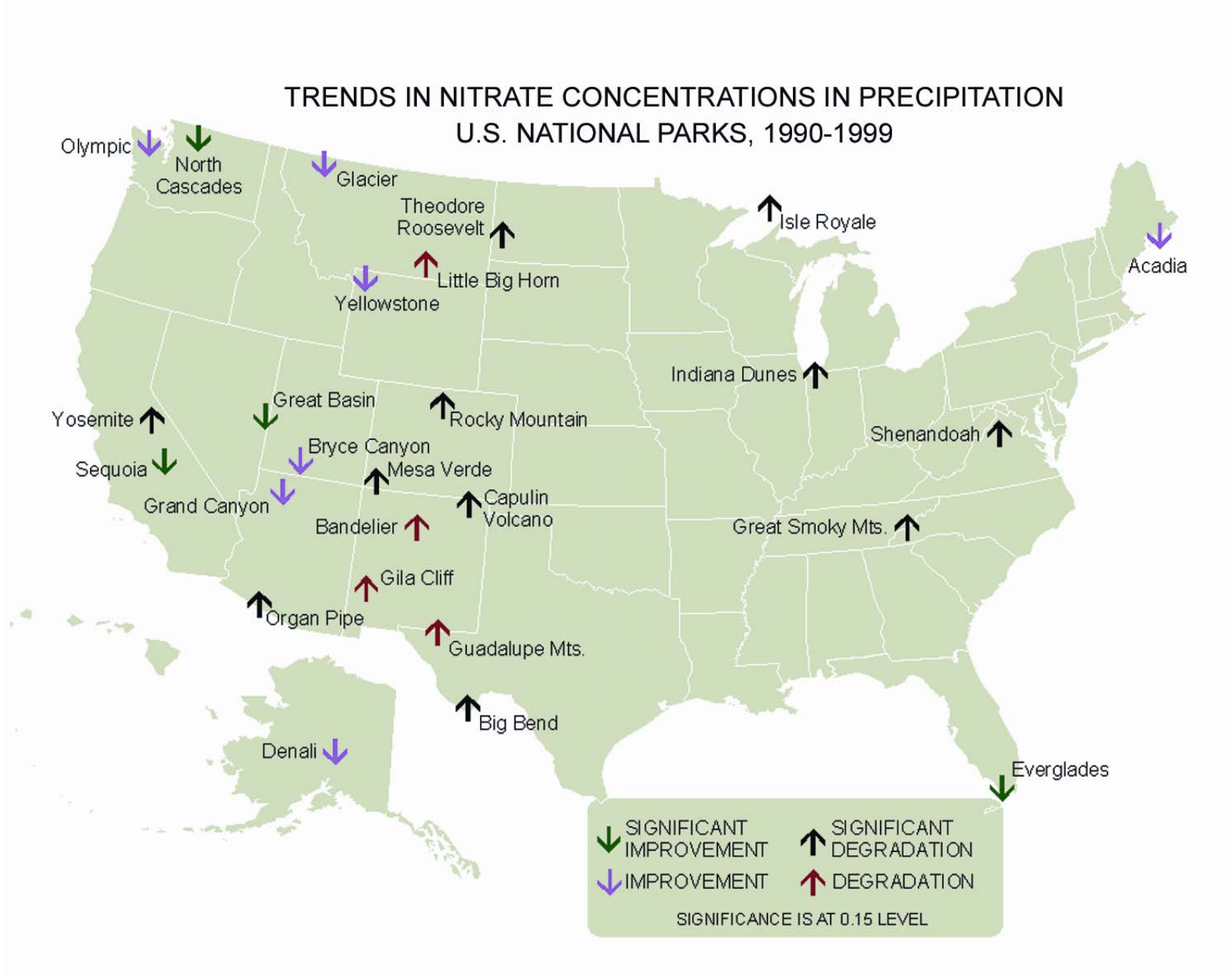
- Many parks have ozone levels high enough to cause foliar injury to sensitive vegetation and injury has been documented in a number of parks; ozone levels are increasing in many areas of the country.

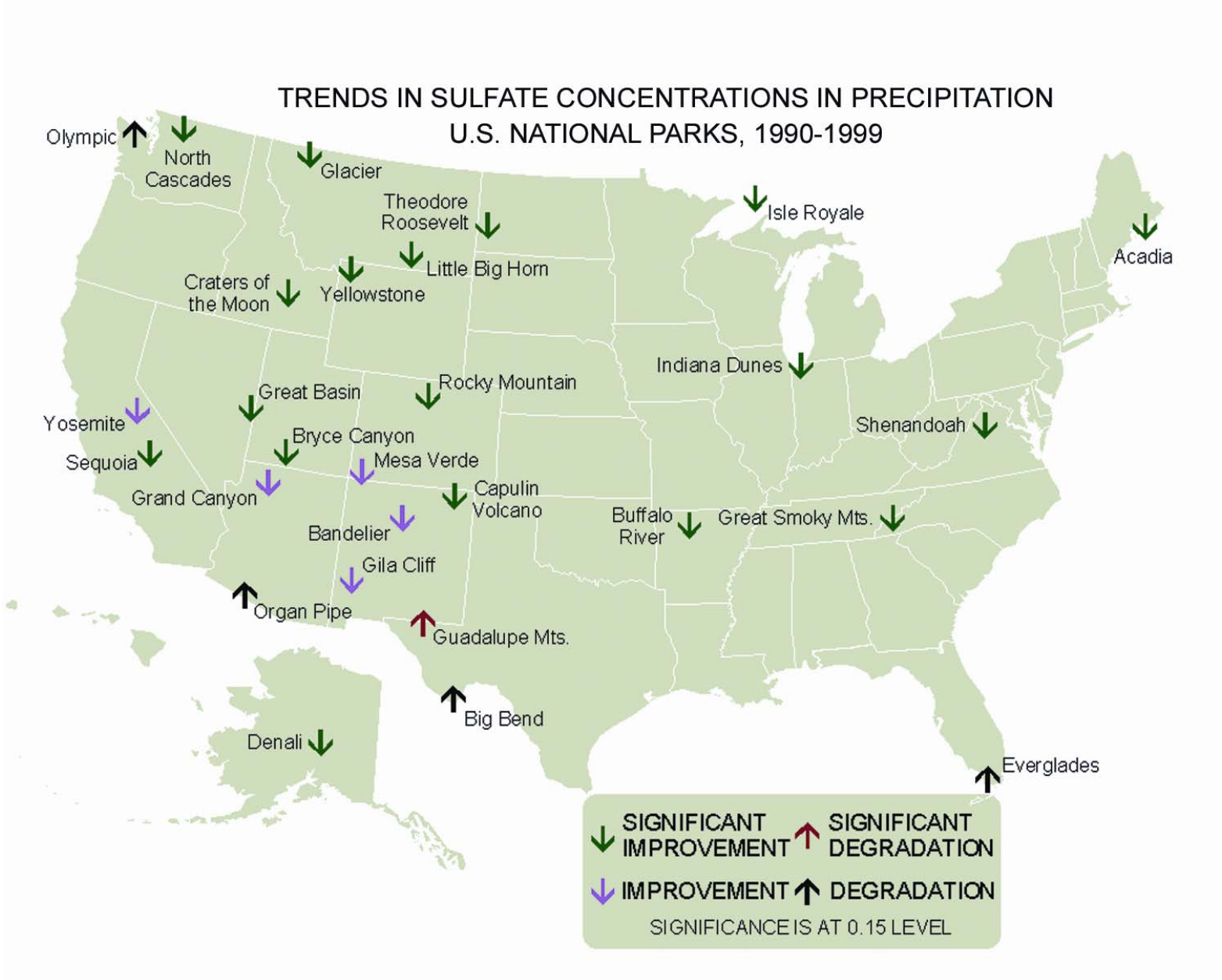
- Many high elevation, upland, and coastal ecosystems are sensitive to atmospheric deposition; nitrogen deposition is increasing in about half the areas monitored and sulfur deposition, although generally decreasing, remains high in many areas. Deposition in all areas is elevated above natural levels.

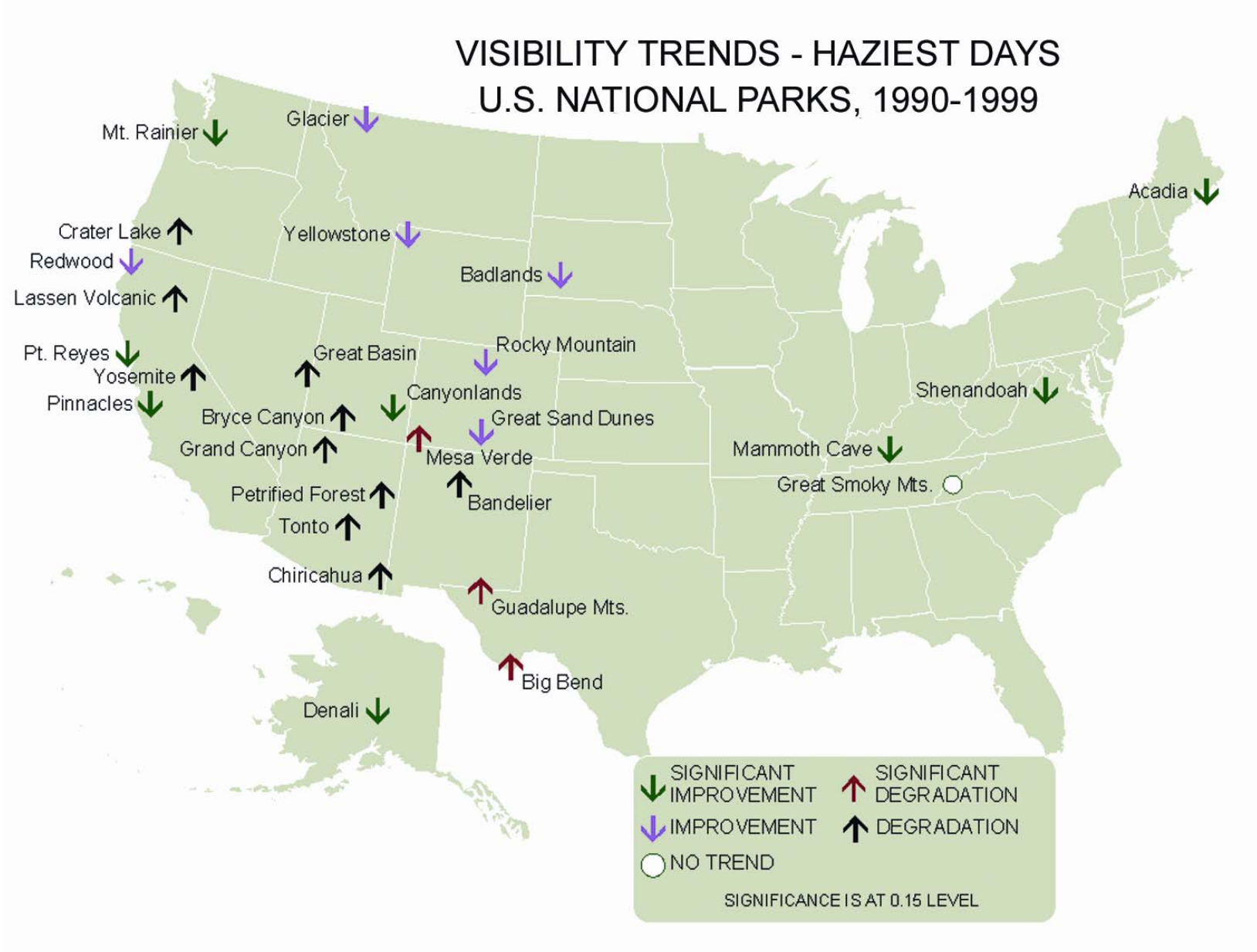
- Visibility is impaired to some degree in all NPs; visibility on the haziest days is getting worse in about half the areas monitored.

http://www2.nature.nps.gov/ard/pubs/aqnps.htm


OZONE TRENDS
MAY-SEP AVERAGE OF THE DAILY 1-HOUR MAXIMUM
U.S. NATIONAL PARKS, 1990-1999
Olympic
Mt. Rainier
Glacier
Voyageurs
Theodore Roosevelt
Acadia
Crater Lake
Craters of the Moon
Yellowstone
Cape Cod
Lassen Volcanic
Great Basin
Rocky Mountain
Yosemite
Pinnacles
Canyonlands
Shenandoah
Sequoia
Grand Canyon
Mesa Verde
Mammoth Cave
Joshua Tree
Great Smoky Mts.
Cowpens
Congaree Swamp
Saguaro
Chiricahua
Chamizal
Big Bend
Denali
Everglades
SIGNIFICANT IMPROVEMENT
SIGNIFICANT DEGRADATION
IMPROVEMENT
DEGRADATION
SIGNIFICANCE IS AT 0.15 LEVEL


TRENDS IN NITRATE CONCENTRATIONS IN PRECIPITATION
U.S. NATIONAL PARKS, 1990-1999
Olympic
North Cascades
Glacier
Theodore Roosevelt
Isle Royale
Acadia
Little Big Horn
Yellowstone
Indiana Dunes
Great Basin
Yosemite
Rocky Mountain
Shenandoah
Bryce Canyon
Sequoia
Mesa Verde
Grand Canyon
Capulin Volcano
Bandelier
Great Smoky Mts.
Gila Cliff
Organ Pipe
Guadalupe Mts.
Big Bend
Denali
Everglades
SIGNIFICANT IMPROVEMENT
SIGNIFICANT DEGRADATION
IMPROVEMENT
DEGRADATION
SIGNIFICANCE IS AT 0.15 LEVEL

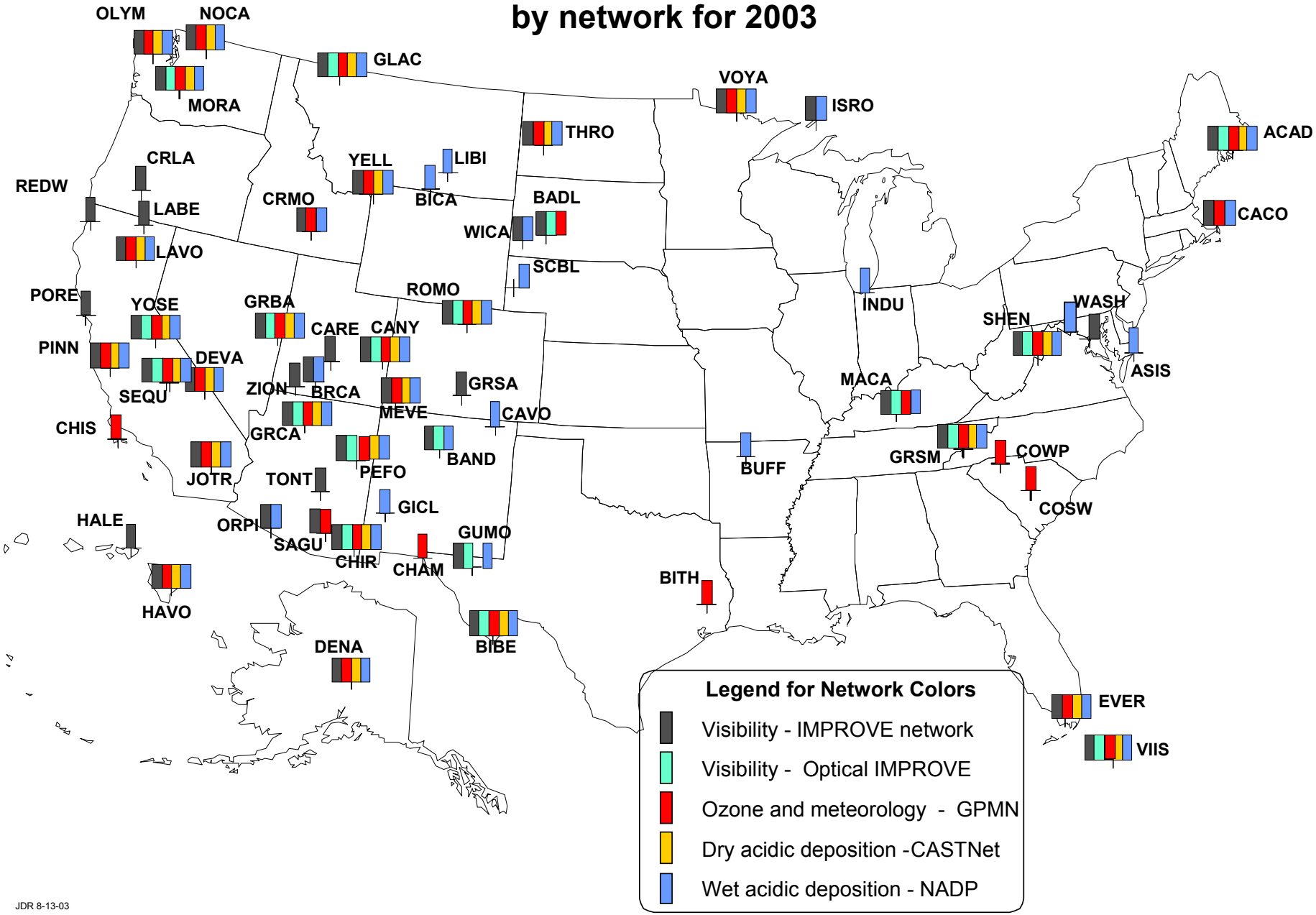

TRENDS IN SULFATE CONCENTRATIONS IN PRECIPITATION
U.S. NATIONAL PARKS, 1990-1999
Olympic
North Cascades
Glacier
Theodore Roosevelt
Isle Royale
Acadia
Little Big Horn
Craters of the Moon
Yellowstone
Indiana Dunes
Great Basin
Rocky Mountain
Yosemite
Shenandoah
Bryce Canyon
Sequoia
Mesa Verde
Grand Canyon
Capulin Volcano
Buffalo River
Great Smoky Mts.
Bandelier
Gila Cliff
Organ Pipe
Guadalupe Mts.
Big Bend
Denali
Everglades
SIGNIFICANT IMPROVEMENT
SIGNIFICANT DEGRADATION
IMPROVEMENT
DEGRADATION
SIGNIFICANCE IS AT 0.15 LEVEL


VISIBILITY TRENDS - HAZIEST DAYS
U.S. NATIONAL PARKS, 1990-1999
Mt. Rainier
Glacier
Acadia
Crater Lake
Yellowstone
Redwood
Badlands
Lassen Volcanic
Pt. Reyes
Great Basin
Rocky Mountain
Yosemite
Canyonlands
Shenandoah
Pinnacles
Bryce Canyon
Great Sand Dunes
Grand Canyon
Mesa Verde
Mammoth Cave
Great Smoky Mts.
Petrified Forest
Bandelier
Tonto
Chiricahua
Guadalupe Mts.
Big Bend
Denali
SIGNIFICANT IMPROVEMENT
SIGNIFICANT DEGRADATION
IMPROVEMENT
DEGRADATION
NO TREND
SIGNIFICANCE IS AT 0.15 LEVEL


NATIONAL PARK SERVICE CLASS I AREAS
Olympic NP
North Cascades NP
Mount Rainier NP
Glacier NP
Voyageurs NP
Isle Royale NP
Roosevelt Campobello IP
Acadia NP
Theodore Roosevelt NP
Crater Lake NP
Yellowstone NP
Grand Teton NP
Redwood NP
Lava Beds NM
Craters of the Moon N M
Badlands NP
Wind Cave NP
Lassen Volcanic NP
Point Reyes NS
Rocky Mountain N P
Yosemite NP
Pinnacles NM
Capitol Reef NP
Arches NP
Black Canyon of the Gunnison NM
Kings Canyon NP
Canyonlands NP
Sequoia NP
Zion NP
Bryce Canyon NP
Great Sand Dunes NM
Mesa Verde NP
Grand Canyon NP
Shenandoah NP
Mammoth Cave NP
Bandelier NM
Great Smoky Mountains NP
Petrified Forest NP
Joshua Tree NP
Saguaro NP
Chiricahua NM
Carlsbad Caverns NP
Guadalupe Mountains NP
ALASKA
Big Bend NP
Denali NP and Preserve
HAWAII
Everglades NP
Haleakala NP
Virgin Islands NP
Hawaii Volcanoes NP
Map produced by the National Park Service Air Resources Division 02/22/1999

Air Quality Monitoring in NPS Units

by network for 2003



JDR 8-13-03

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Air Quality Information vs. Air Quality Related Values Information

Air quality information: includes measurement of pollutants in the air (ozone, particles) and pollutants in deposition (rain, snow, dryfall), visibility parameters

Air quality related values (AQRV) information: includes information on resources sensitive to air pollution (water, soil, plants, animals, visibility, and historical resources)

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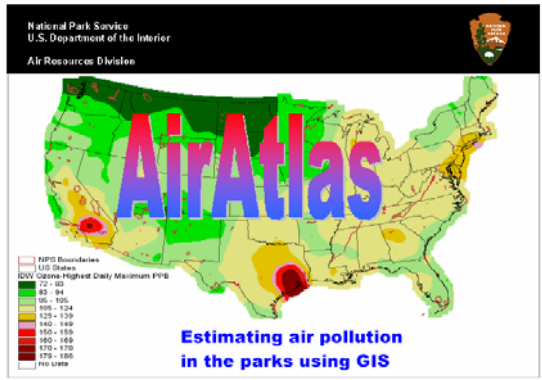
Air Quality Information: Air Atlas

- Estimates of air quality data for all I&M parks, interpolated from all national air quality monitoring networks, displayed on GIS maps
  - » Ozone
  - » Wet deposition of nitrogen, sulfur, etc.
  - » Visibility parameters



http://www2.nature.nps.gov/ard/gas/airatlas-du/viewer_index.htm

Air Quality Related Values Information: Guidance for AQRV Analysis

- AQRV information for parks

http://www2.nature.nps.gov:82/scripts/synth.dll

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Is Air Quality or AQRV Monitoring Needed in a Network?

- Are there significant pollution sources nearby/upwind of the parks?
- Are parks adequately covered by existing ambient monitoring?
- Does air quality monitoring indicate pollution levels are of concern?
- Do parks in the Network have sensitive AQRVs?
- Have AQRVs in park been evaluated for air pollution injury/effect?

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How can ARD help answer these questions?

- Identify air pollution sources near parks
- Identify air quality monitoring in/near parks
- Assist in identifying park-specific AQRVs
- Identify pollutant levels of concern
- Assist in developing recommendations for air quality and AQRV monitoring and research

If "yes" to monitoring

- Vital Signs Monitoring Handbook
  - Air quality and AQRV monitoring guidance includes:
    - Standardized protocols for ozone, wet and dry deposition, visibility, and meteorology
    - Standardized protocols for mercury deposition (under development)
    - Sample protocols for other parameters, e.g., snow and lake chemistry
    - Protocols for ozone injury surveys (under development)

http://www1.nature.nps.gov/im/monitor/handbook.htm